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BIFURCATION AND STABILITY THEORY WITH APPLICATION TO  
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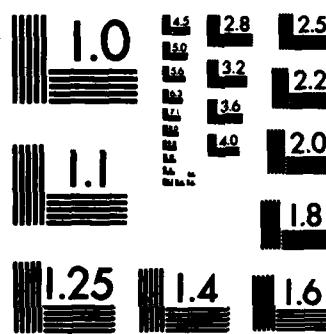
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# Bifurcation and Stability Theory with Application to Problems of Combustion and Flame Propagation

**FINAL REPORT**

Bernard J. Matkowsky

October 30, 1983

U.S. Army Research Office

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We have carried out a research program in Bifurcation and Stability Theory with applications to Combustion and Flame Propagation, in which we determined both qualitative and quantitative behavior of solutions of these problems. In particular we obtained results on the transition from laminar to turbulent combustion. In our study we derived various simplified models from the general equations governing combustion, which were more amenable to mathematical analysis. The methods of bifurcation and stability theory were then employed on the resulting models. A list of all the papers published, is appended. In addition a list of scientific personnel participating in the research program is appended. ←

**LIST OF SCIENTIFIC PERSONNEL**

**Principal Investigator - Prof. B. J. Matkowsky**

**Associate Investigators -- Prof. T. Erneux**

**Prof. A. van Harten**

**Prof. A. K. Kapila**

**Prof. M. Matalon**

**Prof. G. I. Sivashinsky**

**Student -- D. O. Olagunju -- received Ph.D.**

**Thesis title -- "Bifurcation and Stability of Propagating  
Oscillatory Flames"**

LIST OF PUBLICATIONS ON A.R.O. GRANT

- "Singular Perturbations of Bifurcations," S.I.A.M. Journal on Applied Mathematics, Vol. 33, No. 2 (1977), pp. 230-255 (with E. L. Reiss).
- "On Inhibiting Runaway in Catalytic Reactors," S.I.A.M. Journal on Applied Mathematics, Vol. 35, No. 2 (1976), pp. 307-314 (with D. S. Cohen)
- "The Exit Problem for Randomly Perturbed Dynamical Systems," S.I.A.M. Journal on Applied Mathematics, Vol. 33, No. 2 (1977), pp. 365-382 (with Z. Schuss).
- "On the Smooth Transition to Convection," S.I.A.M. Journal on Applied Mathematics, Vol. 34, No. 2 (1978), pp. 322-337.
- "Propagation of a Pulsating Reaction Front in Solid Fuel Combustion," S.I.A.M. Journal on Applied Mathematics, Vol. 35, No. 3 (1978), pp. 465-478 (with G. I. Sivashinsky).
- "Reactive Diffusive Systems with Arrhenius Kinetics: Multiple Solutions, Ignition and Extinction," S.I.A.M. Journal on Applied Mathematics, Vol. 36, No. 2 (1979), pp. 373-389 (with A. K. Kapila).
- "The Exit Problem: A New Approach to Diffusion Across Potential Barriers," S.I.A.M. Journal on Applied Mathematics, Vol. 35, No. 3 (1979), pp. 604-623 (with Z. Schuss).
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- "Secondary States of Rectangular Plates," S.I.A.M. Journal on Applied Mathematics, Vol. 38, No. 1 (1980), pp. 38-51 (with L. J. Putnick and E. L. Reiss).
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- "A Nonlinear Theory of Cellular Flames," S.I.A.M. Journal on Applied Mathematics, Vol. 38, No. 3 (1980), pp. 489-504 (with L. J. Putnick and G. I. Sivashinsky).
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